

GOLD PLACER AND PLATINUM PLACER DEPOSITS AND GABBROIC Ni-Cu AND PODIFORM CHROMITE DEPOSITS

## METALLIFEROUS MINERAL RESOURCE ASSESSMENT MAPS OF THE MOUNT HAYES QUADRANGLE, EASTERN ALASKA RANGE, ALASKA

GOLD PLACER AND PLATINUM PLACER DEPOSITS AND GABBROIC Ni-Cu AND PODIFORM CHROMITE DEPOSITS

Gold placer deposits -- Area of potential for undiscovered. Numbers refer to

Platinum placer deposits -- Area of potential for undiscovered deposits. Numbers refer to table 2

Gabbroic Ni-Cu deposits -- Area of potential for undiscovered deposits. Letters refer to table 13

Podiform deposits -- Area of potential for undiscovered deposits in ultramafic rocks. Letters refer to table 14

DESCRIPTION OF MAP UNITS

Os Surficial deposits (Quaternary)--Alluvium, colluvial deposits, glacial deposits, fluviolacustrine deposits, rock glacier deposits, snow and ice gr Granitic plutonic rocks (early Tertiary(?) to Late Jurassic)--Chiefly medium

to coarse-grained biotite-hornblende granite and hornblende-biotite ranodiorite, with lesser quartz diorite and diorite and sparse monzonite Form moderate to large plutons and sparse dikes. Locally schistose and recrystallized at lower greenschist facies. Individual plutons generally fault bounded in area south of Denali fault. Local intense hydrotherma SEDIMENTARY AND IGNEOUS ROCKS

North of Denali fault Tsc Sandstone, conglomerate, and coal (middle or early Tertiary)--Chiefly conglomerate at the base grading upward into interbedded sandstone and coal. Overlain by interbedded lenses of poorly consolidated siltstone, mudstone, and sparse sandstone. Includes locally extensive coal deposits

in vicinity of Jarvis Creek la Lamprophyre and alkalic gabbro (early Tertiary)--Chiefly panidiomorphic-granular aggregates of olivine, orthopyroxene, clinopyroxene, horn-blende, biotite, plagioclase, and potassium-feldspar containing various amounts of groundmass; fine-grained hornblende, biotite, plagioclase, and opaques and interstitial or replacement carbonate; local embayed

phenocrysts. Occur in small- to moderate-size plutons and dike swarms m Monzonite and monzodiorite (early Tertiary)--Hypautomorphic aggregates of clinopyroxene, biotite, potassium-feldspar, plagioclase. Local white mica and carbonate alteration. Form moderate-size plutons as part of intrusive complex with lamprophyre and alkalic gabbro in north-central

gb Gabbro and mafic plutonic rocks (Tertiary(?) and Cretaceous)--Gabbro and metagabbro with lesser diabase, varying from mainly hypautomorphic granular or ophitic aggregates of hornblende, plagioclase and lesser chlorite, biotite, epidote, and albite. Occur in narrow dikes to small- to

YUKON-TANANA TERRANE

Lake George subterrane North of Tanana River fault Iga Augen gneiss and schist (Mississippian)--Coarse- to medium- grained augen gneiss and schist composed of schistose aggregates of potassium feld-spar, plagioclase, biotite, and quartz. Ductily deformed and regionally netamorphosed at amphibolite facies into mylonitic gneiss and schist. Occur in moderate- to large-size irregularly shaped, homogeneous

plutons intruding schistose granitic plutons and pelitic schist. Relici hypautomorphic-granular texture with relict potassium feldspar phenocrysts. Locally deformed and retrograded to lower greenschist facies Igr Medium-grained gneissose granitic rocks (Devonian)--Chiefly gneissose hornblende-biotite granodiorite and lesser gneissose biotite granite. Relict hypautomorphic-granular texture. Occur in moderate- to large-

size, irregularly shaped, homogeneous plutons intruding pelitic schist.

Ductily deformed and regionally metamorphosed at amphibolite facies into mylonitic gneiss. Locally deformed and retrograded to the lower Igs Coarse-grained pelitic schist (Devonian or older)--Poly- deformed, coarsegrained pelitic muscovite-quartz-biotite- garnet schist derived from

> and retrograded to the lower greenschist facies South of Tanana River fault

quartz-rich to clay-rich shale. Ductily deformed and regionally meta-

morphosed at amphibolite facies into mylonitic schist. Locally deformed

mg Metamorphosed granitic rocks (Devonian)--Chiefly fine- to medium-grained gneissose granite and granodiorite with lesser quartz diorite and diorite.

Ductily deformed and regionally metamorphosed into mylonitic gneiss ntruding pelitic schist, calc-schist, and quartz-feldspar schist. Locally

deformed and retrograded to lower greenschist facies ms Metamorphosed pelitic, calcareous, and quartz-feldspar sedimentary rocks (Devonian or older)--Medium-grained, polydeformed, biotite-muscovite-quartz pelitic schist, garnet-plagioclase schist, and quartz plagioclase-biotite schist derived from shale, marl, and sandstone. Ducti ly deformed and regionally metamorphosed at epidote-amphibolit facies into fine- to medium-grained mylonitic schist. Locally deformed and retrograded to lower greenschist facies

> Jarvis Creek Glacier subterrane South of Elting Creek fault

jcg Fine- to medium-grained gneissose diorite, granodiorite, and granite (Devonian)--Chiefly gneissose hornblende-biotite diorite and granodiorite and lesser augen gneiss or schistose granite. Occur in small- to moderatesize, irregularly shaped, homogeneous plutons. Relict hypautomorphic granular texture. Mainly in Donnelly Dome and benchmark Ober areas intruding pelitic schist and quartzite. Ductily deformed and regionall morphosed at amphibolite facies into mylonitic gneiss and schist. Local retrogression to south to lower greenschist facies

jcv Fine-grained schistose volcanic rocks and pelitic schist (Devonian)--Chiefly olydeformed, fine-grained, schistose meta-andesite and metaquarta keratophyre with lesser metadacite, metabasalt, pelitic schist, quartzite, calc- schist, and marble. Ductily deformed and regionally metamo phosed at greenschist facies into mylonitic schist or local phyllonite. Local intense iron staining, and disseminated and massive sulfide miner-

jcs Fine-grained pelitic schist and quartzite (Devonian or older)-- Chiefly polydeformed, fine-grained pelitic schist and quartzite with lesser calcschist, quartz feldspar schist and marble, and with very sparse schistose metavolcanic rocks. Metasedimentary rocks derived from shale, chert or quartz sandstone, marl, volcanic graywacke, and limestone. Ductily deformed and regionally metamorphosed at greenschist facies into mylonitic schist or local phyllonite. Includes large areas of upper greensouth of Granite Mountain and south of Donnelly Dome. Amphibolite facies minerals to the north are progressively replaced by greenschist-

Hayes Glacier subterrane South of Hines Creek and Mount Gakona faults hgv Fine-grained schistose volcanic rocks and phyllite (Devonian)-- Chiefly polydeformed, schistose to phyllitic meta-andesite and metaquartz keratophyre, and lesser metadacite and metabasalt with locally abundant pelitic-, quartz-, and calc-phyllite. Ductily deformed and regionally

metamorphosed at lower and middle greenschist facies into phyllonite

and blastomylonite. Includes some areas of iron staining and disseminat-

hgs Fine-grained schistose sedimentary rocks (Devonian or older)-- Chiefly pelitic, quartz-, and calc-phyllite. In eastern part of quadrangle, chiefly polydeformed quartz-chlorite-white mica phyllite, graphitic-quartz phyllite, quartz-plagioclase phyllite, calc-phyllite, and marble. Locally meta-andesite, metaquartz keratophyre, and metadacite. In western part of quadrangle, chiefly polydeformed pelitic schist, quartz-mica schist, and lesser quartzite, and calc-schist derived from shale, quartz-siltstone and sandstone, and marble. Derived from shale, chert or quartz siltstone, volcanic graywacke, marl, and limestone. Ductily deformed and regionally metamorphosed at lower and middle greenschist facies into phyllo-

> AURORA PEAK TERRANE South of Nenana Glacier fault and north of Denali fault

ag Metamorphosed gabbro, quartz diorite, granodiorite, and granite (Late Cretaceous)--Regionally metamorphosed plutonic rocks consisting of gneissose gabbro, quartz diorite, granodiorite, and granite, and amphibolite intruding calc- schist, marble, quartzite, and pelitic schist. Relict hypautomorphic granular texture. Ductily metamorphosed and deformed twice, once into mylonitic schist during an earlier period of upper amphibolite facies metamorphism, and later into blastomylonite during a

period of middle greenschist-facies metamorphism as Metamorphosed calcareous, quartzose, and pelitic sedimentary rocks (Triassic to Silurian)--Polydeformed, fine- to medium- grained calc-schist, marble, quartzite, and pelitic schist. Derived from marl, quartzite, and shale. Ductily metamorphosed and deformed twice, once into mylonitic schist during an older period of upper amphibolite facies metamorphism and later into blastomylonite at middle greenschist facies

Within splays of Denali fault w Argillite, siltstone, graywacke, and limestone--(Devonian and Silurian?)--Chiefly weakly metamorphosed argillite, quartz-pebble siltstone, quartz sandstone, graywacke, conglomerate, limestone, and marl, and lesser andesite and dacite. Local weak schistosity. Intensely deformed locally, with development of phyllonite and protomylonite in narrow shear zones. Exhibits incipient lower greenschist-facies meta-

WINDY TERRANE

CORRELATION OF MAP UNITS

SEDIMENTARY AND IGNEOUS ROCKS North of Denali fault Unconformity

YUKON-TANANA TERRANE Lake George subterrane North of Tanana River faul Macomb subterrane South of Tanana River fault Intrusive contact Igr Intrusive contact

Igs Hayes Glacier subterrane South of Hines Creek Jarvis Creek Glacier subterrane and Mount Gakona faults South of Elting Creek fault jcg Intrusive contact **AURORA PEAK TERRANE** 

> South of Nenana Glacier fault and north of Denali fault Intrusive contact WINDY TERRANE Within splays of Denali fault

> > Denali fault

SEDIMENTARY AND VOLCANIC ROCKS AND METAMORPHOSED SEDIMENTARY, VOLCANIC AND PLUTONIC ROCKS

South of Denali fault

TERRANE OF ULTRAMAFIC AND ASSOCIATED ROCKS um Pyroxenite, peridotite, dunite and amphibolite (Mesozoic?)-- Partly serpentinized. Lesser hornblende-plagioclase gneiss, and minor serpentinite, marble, graphitic schist, tonalite, and granite. Earlier pervasive ductil rmation and metamorphism at amphibolite facies. Locally well ed schistosity. Later locally intensely deformed and metamorphosed to lower greenschist

MACLAREN TERRANE South of Denali fault and north of Broxson Gulch thrust East Susitna batholith and schist, quartzite, and amphibolite
South of Denali fault and north of Meteor Peak fault gg Gneissose granitic rocks (early Tertiary and Late Cretaceous)-- Chiefly

polydeformed quartz diorite and granodiorite, with lesser granite. Relict hypautomorphic-granular texture. Regionally metamorphosed and ducti ly deformed at middle amphibolite facies into mylonitic gneiss. Grade into migmatite, migmatitic schist, and schist and amphibolite. Local retrograde lower greenschist-facies metamorphism sa Schist and amphibolite (Early Cretaceous or older)--Hornblende- biotitequartz-plagioclase schist and hornblende-plagioclase- quartz amphibolite. Derived from gabbro, quartz gabbro, diorite, and quartz diorite Relict hypautomorphic-granular texture. Ductily deformed at middle amphibolite facies into mylonitic schist and gneiss. Local retrograde metamorphism to greenschist facies. Relatively older and more highly metamorphosed equivalent of the gneissose granitic rocks of East Susit-

mig Migmatite (Cretaceous?)--Highly contorted schist and amphibolite with abundant diffuse veins of granodiorite. Gradational unit between the gneissose granitic rocks unit (gg), with fragments of nearly completely assimilated schist and amphibolite, and the migmatitic schist unit (mgsh). Contorted schistosity. Contains abundant, small to large granitic

mgsh Migmatitic schist (Cretaceous?)--Chiefly schist and amphibolite with sparse to moderately abundant veins of granitic rock. Attitude of schistosity generally constant over large areas. Gradational unit between schist and amphibolite of Maclaren Glacier metamorphic belt and the migmatite unit (mig). Contains fewer dikes of granitic rock than the migmatite unit

sq Schist, quartzite, and amphibolite (Early Cretaceous or older)-- Chiefly calc-silicate schist, para-amphibolite, and quartzite. Ductily deformed and regionally metamorphosed at amphibolite facies into mylonitic schist. Intruded by the gneissose granitic rocks unit (gg)

Maclaren Glacier metamorphic belt South of Meteor Peak fault mmb Schist and amphibolite, phyllite, and argillite and metagraywacke (Middle Jurassic or older)--Mainly faulted sequence. Metamorphic grade systematically increases from lower greenschist facies in the south to middle

amphibolite facies to the north. Ductily deformed into protomylonite and phyllonite in the argillite and metagraywacke unit, phyllonite in the phyllite unit, and mylonitic schist in the schist and amphibolite unit. Occurs as a fault-bounded unit south of Meteor Peak fault and north of Broxson Gulch thrust. Argillite and metagraywacke unit mainly derived from volcanic graywacke and siltstone, and minor andesite and basalt, with lesser calcareous and quartz siltstone CLEARWATER TERRANE

Within splays of Broxson Gulch thrust CSV Schistose metasedimentary and metavolcanic rocks (Late Triassic)--Chlorite schist, muscovite schist, and marble. Lesser schistose metarhyolite and metarhyodacite flows, and greenstone derived from pillow basalt. Veakly deformed and metamorphosed at greenschist facies. Intensely deformed at faults between units in some areas WRANGELLIA TERRANE

Tsv Sandstone, conglomerate, and volcanic rocks (late and middle Tertiary)--Interbedded, light-colored sandstone, conglomerate, gray siltstone, shale and mudstone, thin coal beds, rhyodacite ash, rhyodacite and dacite tuff, breccia, agglomerate, flows, dikes and sills. Commonly occur as fault- bounded lenses in branches of McCallum Creek-Slate

Ts Sandstone, conglomerate, and coal (middle and early Tertiary)-- Interbedded light-colored sandstone, conglomerate, gray siltstone, shale, and mudstone, coal beds, and thin beds of dacite to rhyodacite flows and tuff. Commonly occur as fault-bounded lenses in branches of Broxson Gulch thrust, Rainy Creek thrust, and Eureka Creek fault JEM McCarthy Formation (Early Jurassic and Late Triassic)--Thin- to mediumbedded calcareous argillite and impure limestone with abundant Mono-

tis. Occurs in branches of Broxson Gulch thrust

ga Gabbro, diabase, and metagabbro (Late Triassic)--Small, irregular bodies, dikes, and sills of medium- to coarse- grained gabbro and fine- to medium-grained diabase, and locally schistose metagabbro that occur throughout the Wrangellia terrane. Gabbro and diabase range from hypautomorphic-granular or ophitic aggregates of clinopyroxene, plagioclase and lesser biotite, to regionally metamorphosed metagabbro con posed of schistose aggregates of hornblende or actinolite, chlorite, bio-tite, epidote, and albite. In some areas may be late Paleozoic in age and part of the igneous suite in the Slana Spur Formation and Tetelna Vol-

cu Cumulate mafic and ultramafic rocks (Late Triassic?)--Moderate- size to large sills of olivine, olivine-clinopyroxene, and clinopyroxene-plagio-clase cumulate. Partly to mostly serpentinized. Locally intensely deformed into serpentinite, actinolite-chlorite schist, or talc schist. Occur as large sills in the Tangle subterrane, and as fault-bounded lenses in the Slana River subterrane

Slana River subterrane South of Denali fault and Broxson Gulch thrust and north of Eureka Creek fault

KJs Marine sedimentary rocks (Early Cretaceous and Late Jurassic)-- Interlayered gray argillite, siltstone, graywacke, pebble conglomerate, and andesite. Abundant graded and rhythmic bedding, sole marks, and slump folds in some areas. Interpreted as deep marine turbidite deposits. Locally isocli-Rn Nikolai Greenstone (Late Triassic)--Subaerial, amydgaloidal basalt flows separated by thin beds of nonmarine volcaniclastic rocks in some areas. Predominantly intermixed aa and pahoehoe flows. Individual flows as

thick as several meters. Usually ophitic or hypautomorphic-granular

nolite, epidote, chlorite, albite, and sericite. Quartz veins and altered

with clinopyroxene, plagioclase, and magnetite. Generally regionally metamorphosed and locally schistose with abundant metamorphic acti-

zones areas with Cu-sulfide minerals in some areas Pe Eagle Creek Formation (Early Permian)--Argillite and limestone. Argillite--dark gray and thin bedded and local calcareous siltstone and thin limestone. Limestone--thin bedded to massive and light to dark gray, with thin argillite interbeds. Chert nodules and thin layers of chert, volcanic graywacke, and clastic limestone in some areas. Local grading and crossbedding. Pervasively metamorphosed to lower greenschist facies. Locally intensely metamorphosed in some areas near Denali fault

VOLCANIC, AND PLUTONIC ROCKS South of Denali fault TERRANE OF ULTRAMAFIC AND ASSOCIATED ROCKS MESOZOIC(?) Splay of Denali fault MACLAREN TERRANE CLEARWATER TERRANE South of Denali fault and Within splays of Broxson Gulch thrust north of Broxson Gulch thrust

SEDIMENTARY AND VOLCANIC ROCKS

East Susitna batholith and schist, quartzite, and amphibolite South of Denali fault and north of Meteor Peak fault CRETACEOUS mig CRETACEOUS(?) Intrusive contact Maclaren Glacier metamorphic belt South of Meteor Peak fault WRANGELLIA TERRANE Broxson Gulch thrust Disconformity Unconformity Intrusive contact Slana River subterrane Tangle subterrane South of Eureka Creek fault CRETACEOUS AND JURASSIC KJs Tanf Disconformity Tan Tinp Disconformity Disconformity

Pi Shallow-level intrusive stocks, dikes, sills, and small plutons (Permian?)--Small to moderate-size intrusive stocks, dikes, and sills.

Mainly dacite with lesser andesite, rhyodacite, and diabase, generally fine grained. Local small plutons of granodiorite and granite. Porphyritic with relict plagioclase phenocrysts in some areas. Weakly schistose in some areas. Pervasively, weakly metamorphosed to lower greenschist facies. Local intense hydrothermal alteration minerals of sericite, chlorite, epidote, actinolite, albite, potassium- feldspar, and clay. Local iron

Intrusive contact

PERMIAN

PERMIAN(?)

PENNSYLVANIAN

PALEOZOIC

staining and disseminated sulfide minerals PPs Slana Spur Formation (Early Permian to Middle Pennsylvanian)-- Thick sequence of marine calcareous (upper part) and noncalcareous (lower part) volcaniclastic rocks, and lesser volcanic sandstone, conglomerate, tuff, volcanic breccia and flows, and limestone. Fine to coarse grained. Volcanic rock generally dacite and lesser andesite, rhyodacite, and ba salt. Medium to thick bedded. Local abundant graded and crossbedded. Weakly schistose to massive. Pervasively metamorphosed to lower greenschist facies. Local abundant iron staining. Disseminated and massive sulfide minerals

Pt Tetelna Volcanics (Pennsylvanian)--Chiefly dark-gray-green andesite and dacite flows, with sparse basalt flows and local volcanic breccia, volcanic graywacke, conglomerate, and tuff. Fine to coarse grained. Thin to thick bedded. Weakly schistose to massive. Pervasively metamorphosed to lower greenschist facies. Local abundant iron staining. Disseminated

Tangle subterrane South of Eureka Creek fault Il Limestone (Late Triassic)--Ranges from fine-grained gray limestone to medium-grained gray or white marble. Thick bedded to massive. Weakly schistose. General pervasively recrystallized. Locally faulted and sheared. Locally metasomatized to skarn near granitic plutons

Nikolai Greenstone (Late Triassic) Finf Subaerial basalt flows and minor associated shale, chert, and siltstone. Subaerial, amydgaloidal basalt flows separated locally by thin beds of onmarine volcaniclastic rocks and local thin beds of shale, chert, and siltstone. Predominantly intermixed aa and pahoehoe flows. Individual flows as much as a few meters thick. Common ophitic texture or hypautomorphic-granular texture with clinopyroxene, plagioclase, and magnetite. Generally regionally metamorphosed and locally schistose with abundant metamorphic actinolite, epidote, chlorite, albite, and sericite. Similar to the Nikolai Greenstone in the Slana River subterrane. Local quartz veins and altered areas contain Cu-sulfide minerals knp Pillow basalt flows. Massive pillow basalt flows, and minor basaltic breccia and tuff, and argillite. Basalt similar to subaerial basalt flows of the

albite, and sericite. Local quartz veins and altered areas including Cu-Pzt Aquagene tuff, argillite, limestone, chert, andesite tuff, and greenstone (late calcite limestone and marble, red and black chert, and gray-green tuff and basalt. Medium to thick bedded. Weakly schistose to massive.

Nikolai Greenstone. Weakly schistose to massive. Generally regionally

metamorphosed with abundant metamorphic actinolite, epidote, chlorite,

Pervasively metamorphosed to lower greenschist facies Contact--Dotted where concealed

——— Fault--Dashed where approximately located; dotted where concealed Anticline or antiform-Dashed where approximately located; dotted where concealed; showing direction of plunge Overturned antiform--Showing direction of dip of limbs; dotted where

--+ Syncline or synform--Showing direction of plunge; dashed where approximately located; dotted where concealed Strike and dip of beds

Vertical

Strike and dip of schistosity Inclined

Vertical

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